MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2016/2017

EPM1016 – INSTRUMENTATION AND MEASUREMENT TECHNIQUES

(TE, RE, BE)

29 MAY 2017
2.30 p.m. – 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 5 pages including cover page with 4 Questions only.

2. Attempt **ALL** the questions. The distribution of the marks for each question is given.

3. Please write all your answers in the Answer Booklet provided.

Question 1

a) List out 4 basic requirements of a transducer. [4 marks]

b) What is the span of a zero centered voltmeter having a scale from -10V to 10V? If the voltmeter has 100 divisions, what will be the resolution? [2 marks]

c) A (0-25)A ammeter has a guaranteed accuracy of 2% of full scale reading. The current measured by this ammeter is 10A. Calculate the limiting error in percentage. [3 marks]

d) A multimeter having a sensitivity of 3000Ω/V is used to measure the voltage across a circuit having and an output resistance of 10KΩ. The open circuit voltage of the circuit is 6V. Determine the reading of the multimeter when it is set to its 10V scale and then solve for the percentage error. [4 marks]

e) The torque of an ammeter varies as the square of the current going through it. If a current of 5A produces a deflection of 90°, what deflection will occur for a current of 3A when the instrument is the type of
   i. spring-controlled? [4 marks]
   ii. gravity-controlled? [4 marks]
   iii. Briefly explain why gravity-controlled is inferior to spring-controlled? [4 marks]

Continued...

Question 2

a) During the measurement of power by two wattmeter method the total input power to a 3-phase 440V motor running at power factor of 0.8 was found to be 25kW. Determine the reading of the two wattmeters. What is the total reactive power if it is a balanced 3 phase system? [9 marks]

b) A three phase balanced delta-connected load draws 40kW at a power factor of 0.85 lag from a three phase balanced 400V, 50Hz supply. Determine the
   i. phase current and line current. [3 marks]
   ii. reactive power and VA per phase. [4 marks]
   iii. resistance and reactance of each phase. [4 marks]

c) In a test run of 30-minute duration with a constant current of 5A, the DC ampere-hour meter registers 525Wh. The supply voltage is 220V.
   Calculate the error and state whether the meter is fast or slow. [5 marks]

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Question 3

a) Is the circuit of Figure Q3(a) a *balanced bridge*? Justify your answer. [2+2 marks]
Determine the currents through R_1 and R_4 in the circuit. [6 marks]

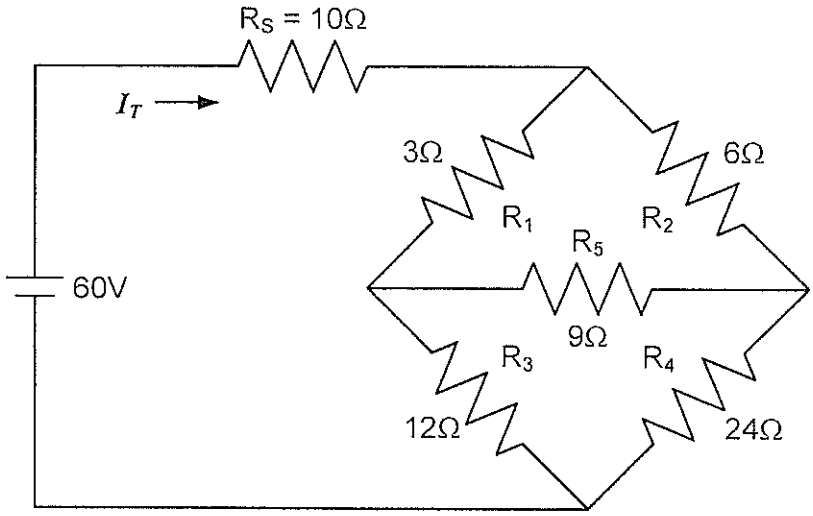

Figure Q3(a)

b) The circuit in Figure Q3(b) is supplied with the source E = 10V∠0° at frequency 1 kHz.

i. What are the values of R_1 and R_3 for the bridge to be balanced? [6 marks]
ii. What is the Q-factor for the series inductance L_x and resistance R_x? [3 marks]
iii. Solve for the current I when the bridge is balanced. [6 marks]

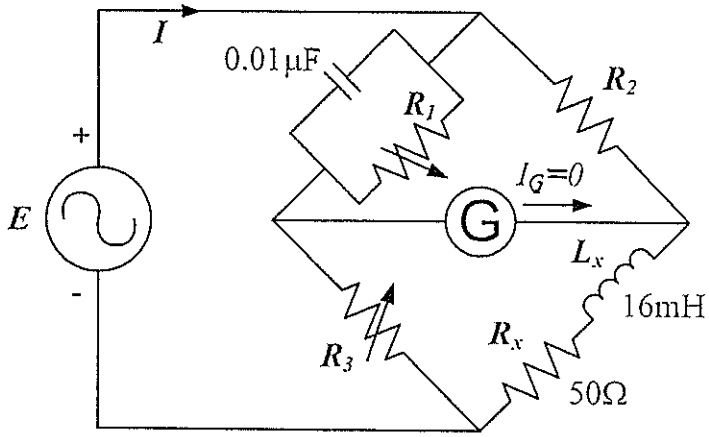

Figure Q3(b)

Continued...

Question 4

a) A toroidal core with a diameter of 6cm circular cross section in Figure Q4(a) has a mean radius, R of 12cm and known permeability of 5×10^{-3}. If a coil of 120-turn carrying a current of 3A is wound around the core, determine the

i. cross section area, A. [2 marks]
ii. reluctance of the toroidal, $\Re_c$. [2 marks]
iii. magnetic flux density, B. [4 marks]
iv. intensity, H and mmf, F. [4 marks]

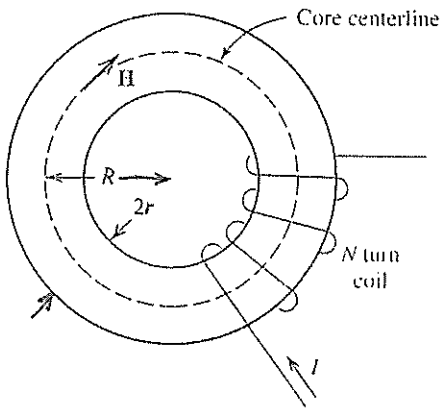

Figure Q4(a)

b) Given $R_2 = R_3 = 100\Omega$ in the bridge circuit of Figure Q4(b). The strain gauge resistance of zero strain is 120 Ω, and the value of R_4 is adjusted to bring the bridge to balance at zero-strain condition. If the gauge factor is known to be 2.0, determine the galvanometer current when $\varepsilon = 400\ \mu$m/m.

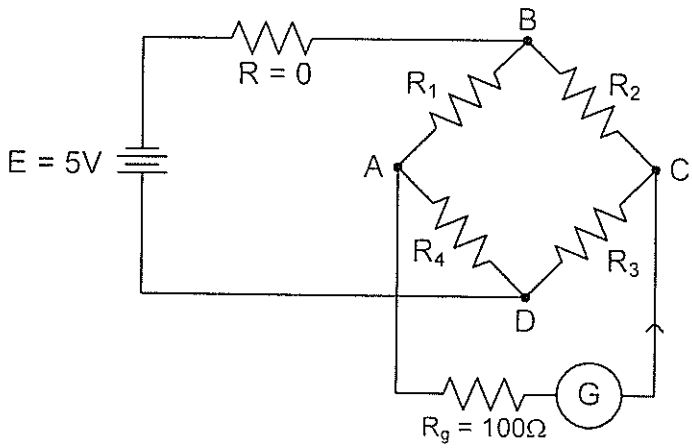

Figure Q4(b)

[13 marks]

End of paper.